OPTEC Laser – Dose Calibration

Here is described how to get the "Depth Vs Laser Dose" calibration curve for any given material.

<u>It is important</u> to perform the calibration with a fixed couple of "demagnification + mask number", corresponding to that of the final wanted machining size!

For the same output energy of the laser source, different couples of "demagnification + mask number" in the optical path can give equivalent final beam spot sizes, but different energy densities, hence different calibration curves!

For the same final spot size on the sample: higher demagnification => larger primary mask opening => larger amount of energy through! This is confirmed by measuring the energy delivered on the sample:

Laser	Demag	Primary mask	Final spot size	Measured energy	Energy density
setpoint		opening	on sample	on sample	on sample
5mJ	10X	0.8mm	78µm	0.11mJ	2.2J/cm ²
5mJ	16X	1.25mm	77µm	0.22mJ	4.6J/cm ²

1. Start the "Matrix Process" from the Tools menu.

2. Into *Process Type*, select either "Points" (static calibration) or "Lines" (dynamic calibration).

pe Process	Stages / Matrix	Mask / MRA			
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				10-10-52-50	

If selecting "Points" for static calibration, make sure the machining holes are large enough so mechanical or optical measurements of the depth is possible! As a guideline, the mechanical profiler Dektak available at CMi is zone4 has a 12.5µm tip with following limits:



Measurement limits of Dektak profiler machine with a 12.5µm tip

Also, when doing a static calibration with points, found values will still be valid for dynamic machining because the vector travelling speed of the stage will adapt itself to deliver a constant dose at each pixel of the design, i.e. at each "static" position. The vector travelling speed of the stage is calculated according the following formula:

Speed =
$$\frac{\text{shot_frequency * spot_size}}{\text{shot_dose}}$$

If static calibration is not possible because the wanted machining width and depth do not allow for easy measurement, then the option "Lines" is needed to machine grooves. The sample will then have to be cut/cleaved through the grooves to allow for cross-section depth measurement (optical measurement).

- 3. Into Laser, define laser parameters for starting point of calibration.
- 4. Geometrical dimension of the matrix and laser parameters variation through the X and Y dimensions of the matrix is done in the "Stages/Matrix" tab.
- 5. The tab "Mask/MRA" allows selection of the primary mask opening.
- 6. The *Zone/Execution* gives options for executing the job directly or not, and/or to save the defined matrix or not.

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